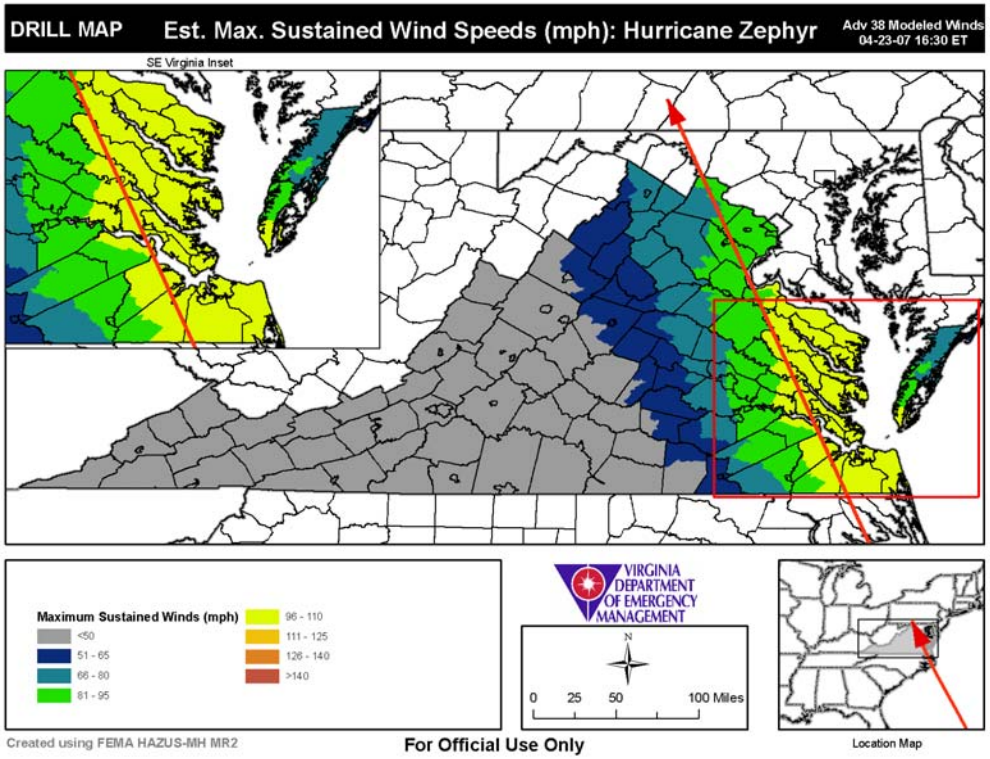
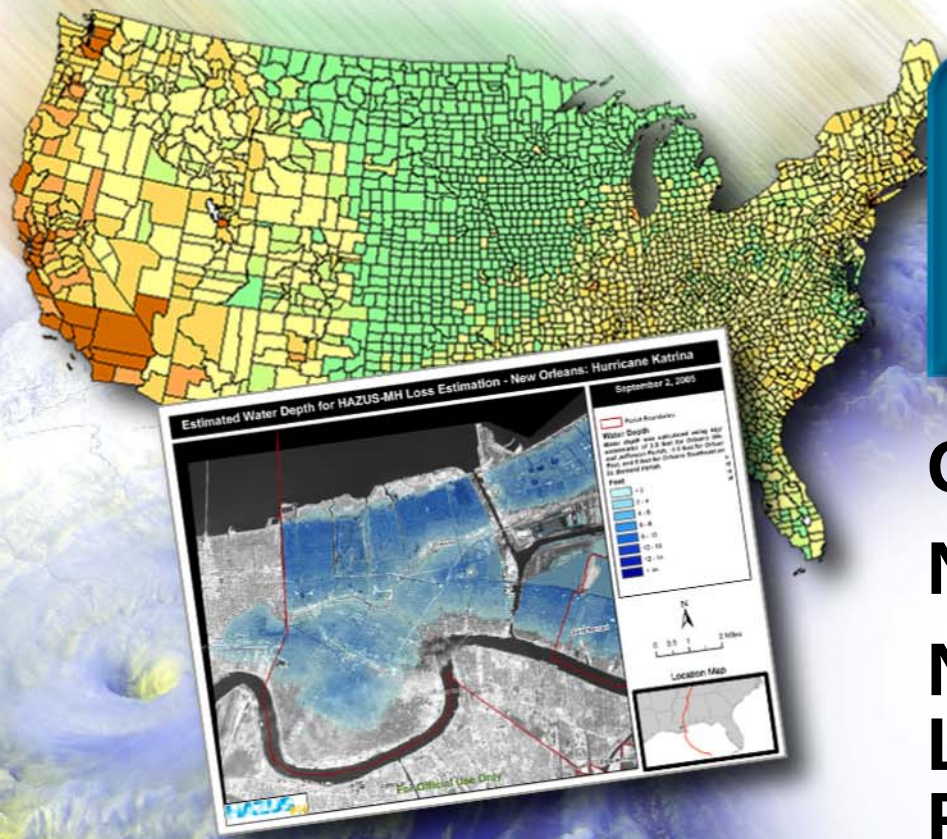
Use of HAZUS-MH to Support Virginia DEM Programs & Missions



March 11, 2008

HAZUS-MH: Features



Physical Impacts

Economic Impacts

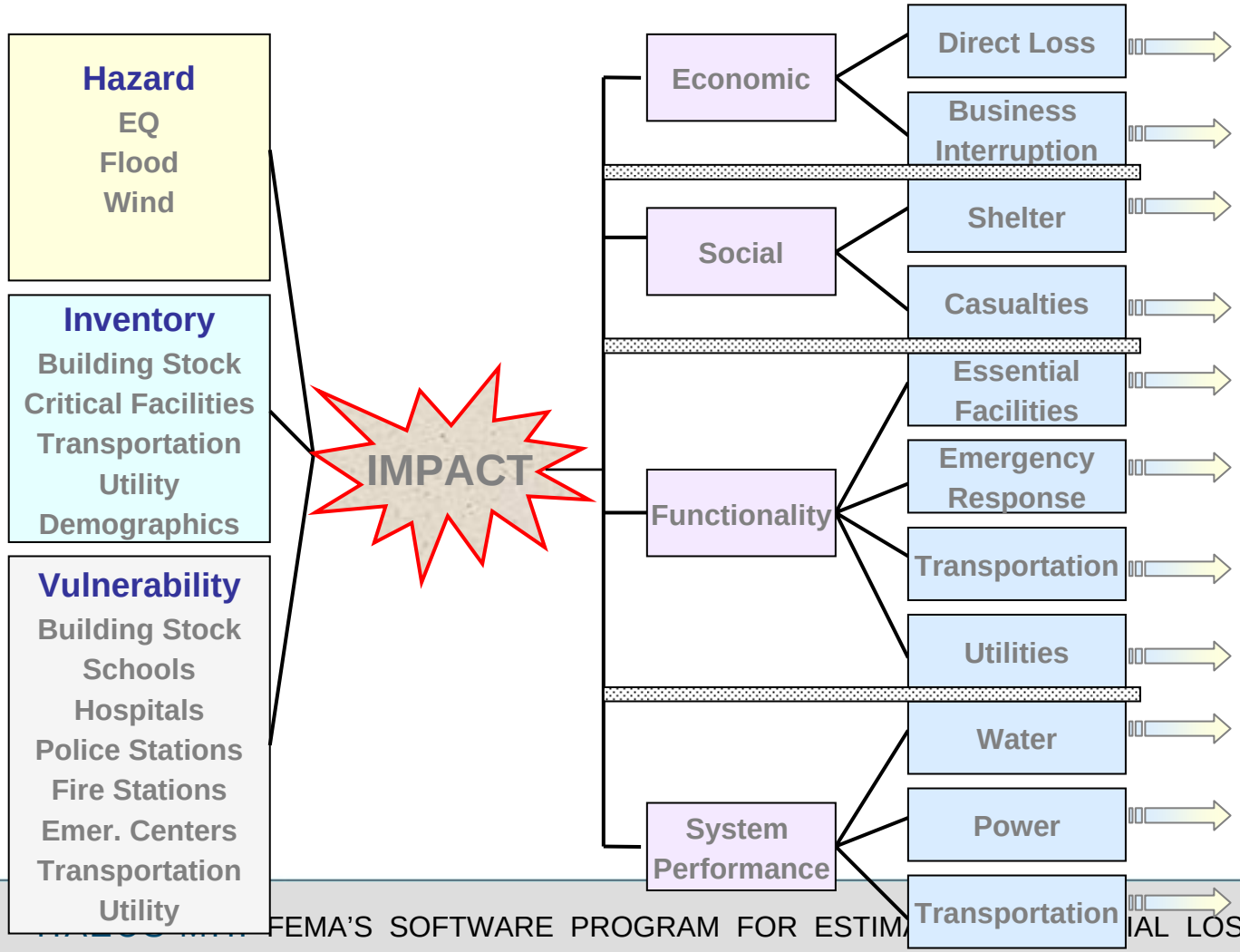
Social Impacts

GIS Technology

Nationwide Databases

Nationally Standardized Loss Estimation and Risk Assessment Methodology

HAZUS-MH Model Methodology



HAZUS quantifies impacts in terms of economic and social losses, functionality, and system performance

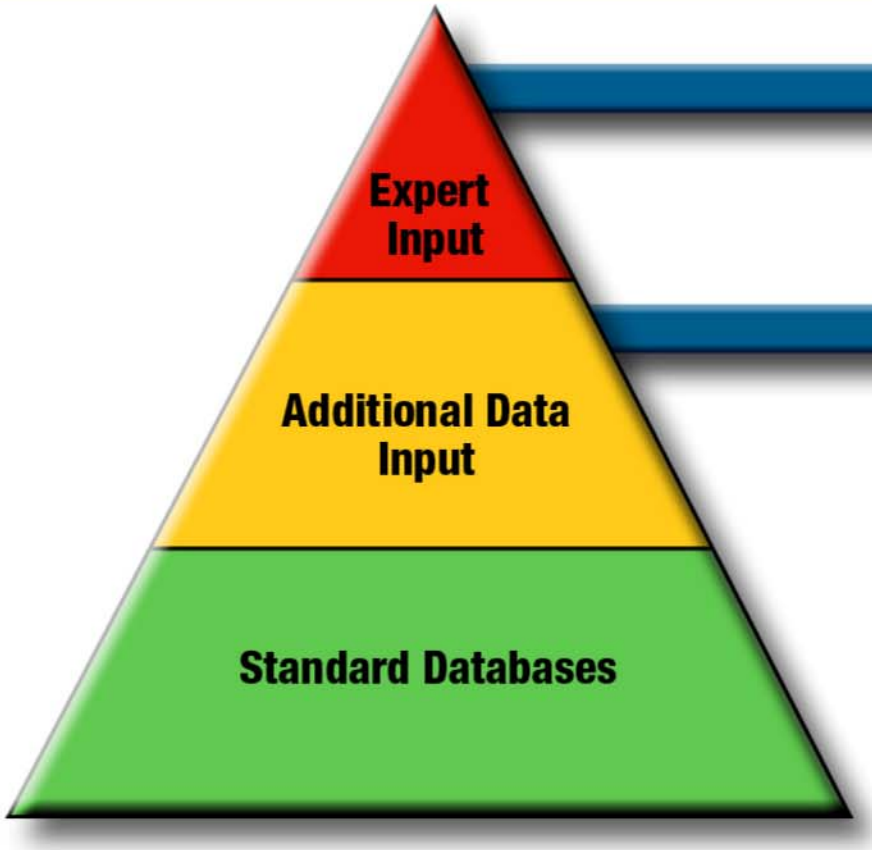
HAZUS-MH is for any size study area

- **Region**
- **Community**
- **Neighborhood**
- **Individual Site**

HAZUS-MH Nationwide Databases

- **Demographics –** Population, Employment, Housing
- **Building Stock –** Residential, Commercial, Industrial
- **Essential Facilities –** Hospitals, Schools, Police Stations, Fire Stations
- **Transportation –** Highways, Bridges, Railways, Tunnels, Airports, Ports and Harbors, Ferry Facilities
- **Utilities –** Waste Water, Potable Water, Oil, Gas, Electric Power, Communication Facilities
- **High Potential Loss Facilities –** Dams and Levees, Nuclear Facilities, Hazardous Material Sites, Military Installations

HAZUS-MH: Analysis Levels



Parameter Modification

FIT (Flood Information Tool)
CDMS (Comprehensive Data Management System*)
BIT (Building Inventory Tool)
InCAST (Inventory Collection and Survey Tool)

* The CDMS Tool replaces the BIT and InCAST Tools in HAZUS-MH MR3 (Version 1.3)

Level 1 and 2 analyses can usually be performed by emergency services or planning staff

Level 3 analysis typically requires technical expertise

Applications of HAZUS-MH

HAZUS-MH: FEMA'S SOFTWARE PROGRAM FOR ESTIMATING POTENTIAL LOSSES FROM DISASTERS

Losses Avoided Analysis for Wind

Residential Buildings and Contents – Structural Protection

Annualized Loss for Residential Units ($1,000)			
	Before Mitigaton	After Mitigation	Savings
Building	$44,357,000	$14,048,000	$30,309,000
Contents	$14,449,000	$3,918,000	$10,531,000
Total	$58,806,000	$17,966,000	$40,840,000

Mitigation Options

Single Family and Multi Family Residences:

- ✓ Shutters on all windows and entry doors
- ✓ Roof-wall connection clips/straps
- ✓ Superior roof deck attachment
- ✓ Secondary water resistance

Manufactured Housing:

- ✓ Tie-Downs
- ✓ Shutters

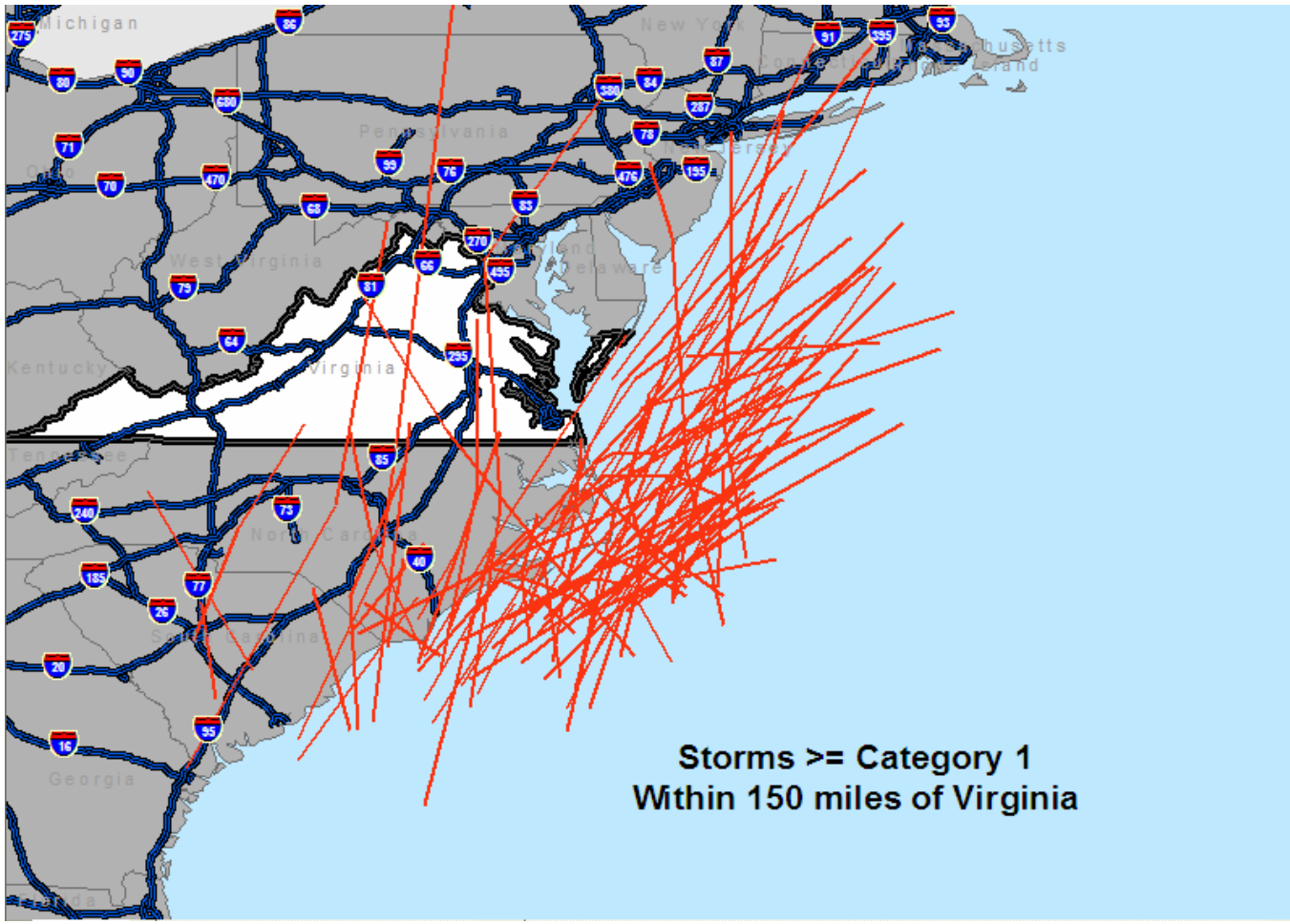
Using HAZUS for Rapid Needs Assessment and Response

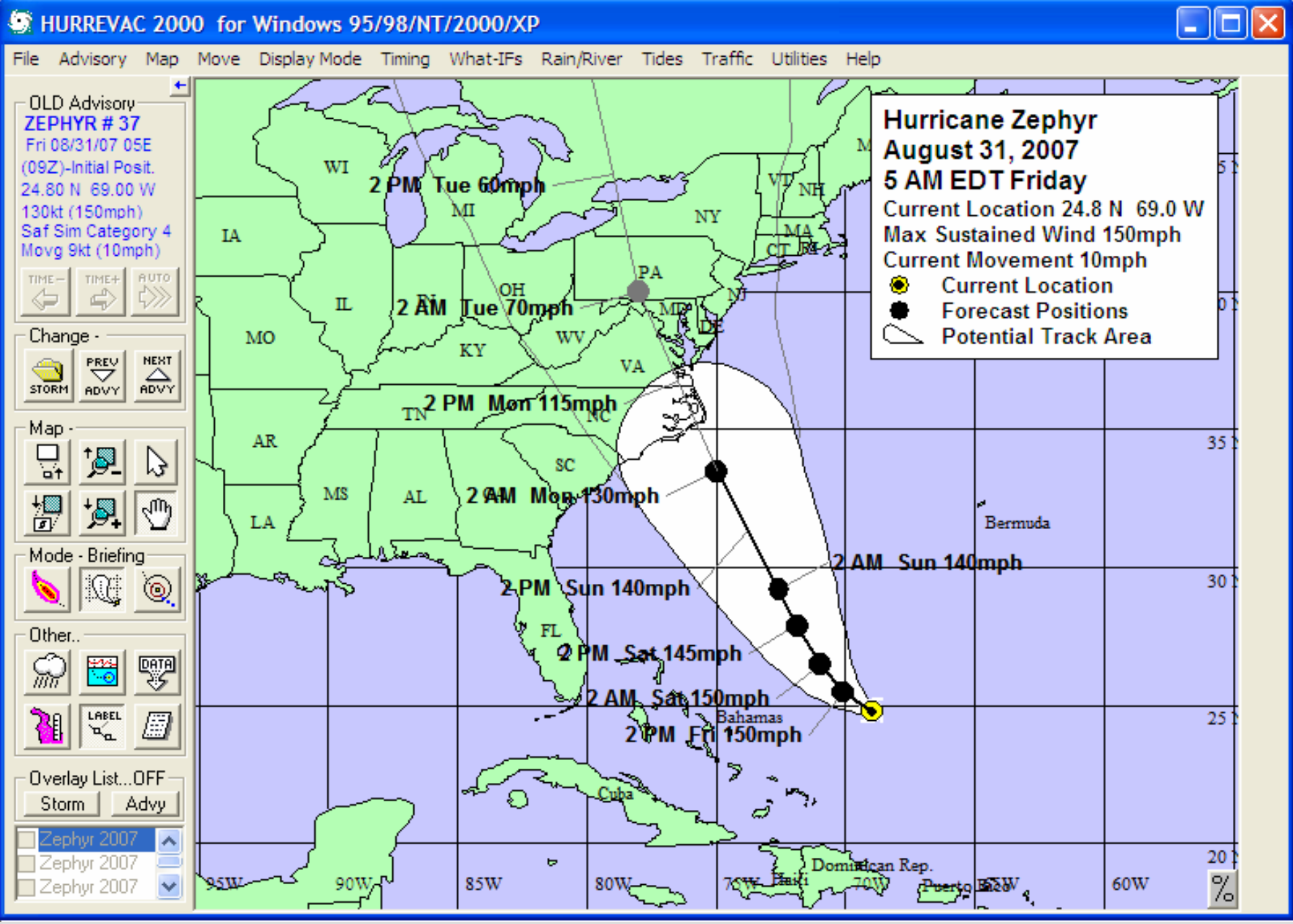
- **More than 3 days prior to landfall, use "scenario storms" or historical storm tracks**
- **Begin "live" HAZUS runs when the 3 day error cone intersects the study region**
  - **Set a schedule for updated model runs**
    - Daily beginning at 3 days before landfall
    - Run the model when the forecast intensity or storm track change dramatically.
    - Immediately after landfall, create a "Best Track"

Storms of Record

- **Know the storms of record for your region.**
  - **Where do they tend to form?**
  - **What are the typical angles of approach?**
  - **What hypothetical storm has the greatest potential impact?**
    - Demographics – Proximity to population centers
    - Intensity – Relationship between intensity and damage
    - Time of Year – How do storm track and intensity correspond to landfall month?
  - **How do these historical and scenario storms compare to building codes?**

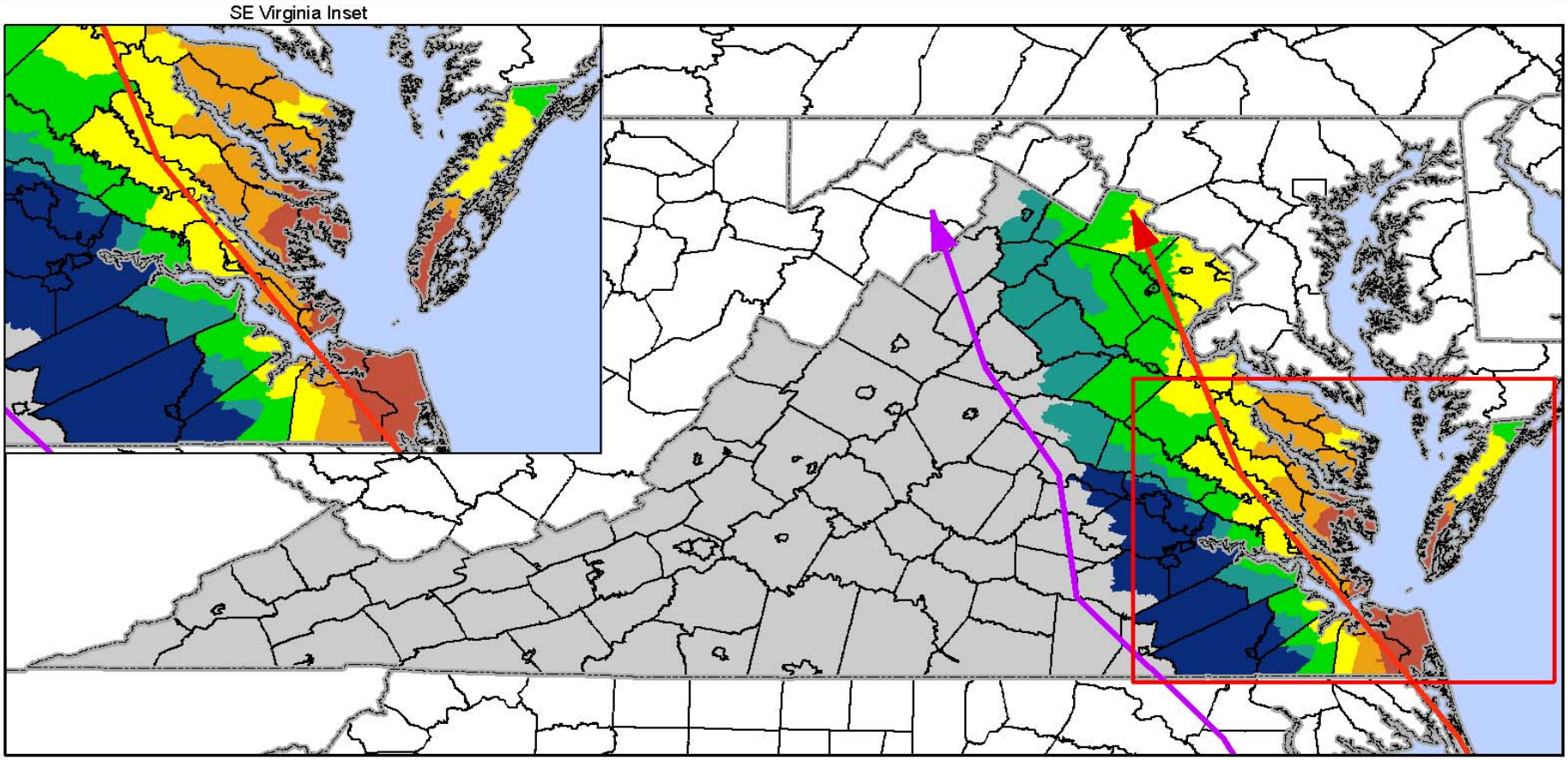
Storms of Record




HURREVAC 2000 for Windows 95/98/NT/2000/XP
File Advisory Map Move Display Mode Timing What-IFs Rain/River Tides Traffic Utilities Help
OLD Advisory
ZEPHYR # 37
Fri 08/31/07 05E
(09Z)-Initial Posit.
24.80 N 69.00 W
130kt (150mph)
Saf Sim Category 4
Movg 9kt (10mph)
Change -
STORM
PREV ADVY
NEXT ADVY
Map -
Mode - Briefing
Other..
DATA
LABEL
Overlay List...OFF
Storm
Advy
Zephyr 2007
Zephyr 2007
Zephyr 2007
Hurricane Zephyr
August 31, 2007
5 AM EDT Friday
Current Location 24.8 N 69.0 W
Max Sustained Wind 150mph
Current Movement 10mph
Current Location
Forecast Positions
Potential Track Area
2 PM Tue 60mph
2 AM Tue 70mph
2 PM Mon 115mph
2 AM Mon 130mph
2 AM Sun 140mph
2 PM Sun 140mph
2 PM Sat 145mph
2 AM Sat 150mph
2 PM Fri 150mph
WI
MI
IA
IL
MO
OH
KY
WV
VA
PA
NY
VT
NH
MA
CT
RI
MD
DE
NJ
TN
NC
SC
AR
MS
AL
GA
LA
FL
Bermuda
Bahamas
Cuba
Dominican Rep.
Haiti
Puerto Rico
95W
90W
85W
80W
75W
70W
60W
35
30
25
20

DRILL MAP — Zephyr Modeled Peak Wind Gusts Relative to Isabel

Best Track Windfield
04-25-07 08:00 ET



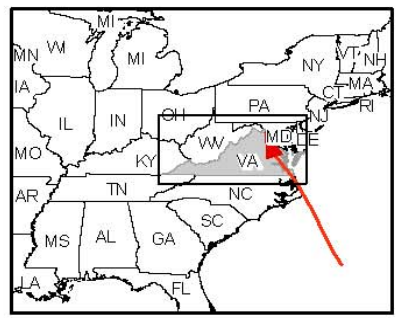
Zephyr Peak Gust Relative to Isabel

- 15+ mph < Isabel
- 5-15 mph < Isabel
- Approx Same as Isabel
- 6-15 mph > Isabel
- 16-25 mph > Isabel
- 25+ mph > Isabel
- Zephyr Track
- Isabel Track
- County Boundaries
- State Boundaries

VIRGINIA DEPARTMENT OF EMERGENCY MANAGEMENT

N

0 25 50 100 Miles



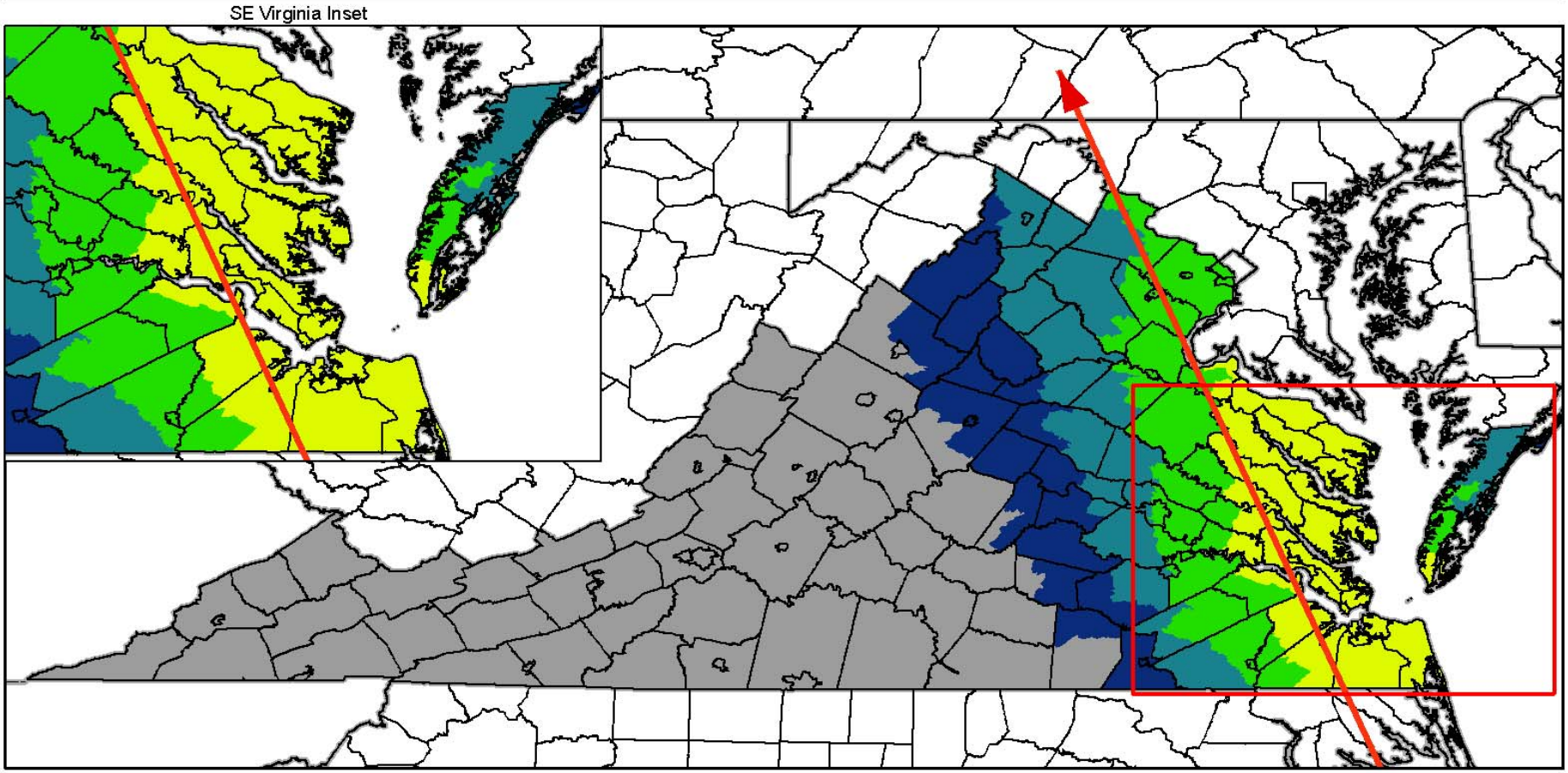
Location Map

Created using FEMA HAZUS-MH MR2

For Official Use Only

DRILL MAP Est. Max. Sustained Wind Speeds (mph): Hurricane Zephyr

Adv 38 Modeled Winds
04-23-07 16:30 ET



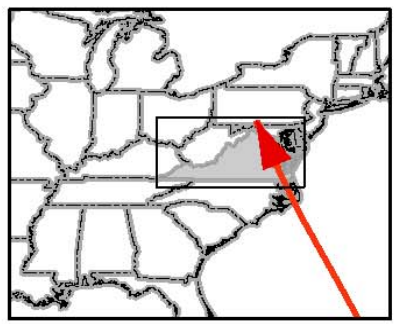
Maximum Sustained Winds (mph)

- <50
- 51 - 65
- 66 - 80
- 81 - 95
- 96 - 110
- 111 - 125
- 126 - 140
- >140

VIRGINIA DEPARTMENT OF EMERGENCY MANAGEMENT

N

0 25 50 100 Miles

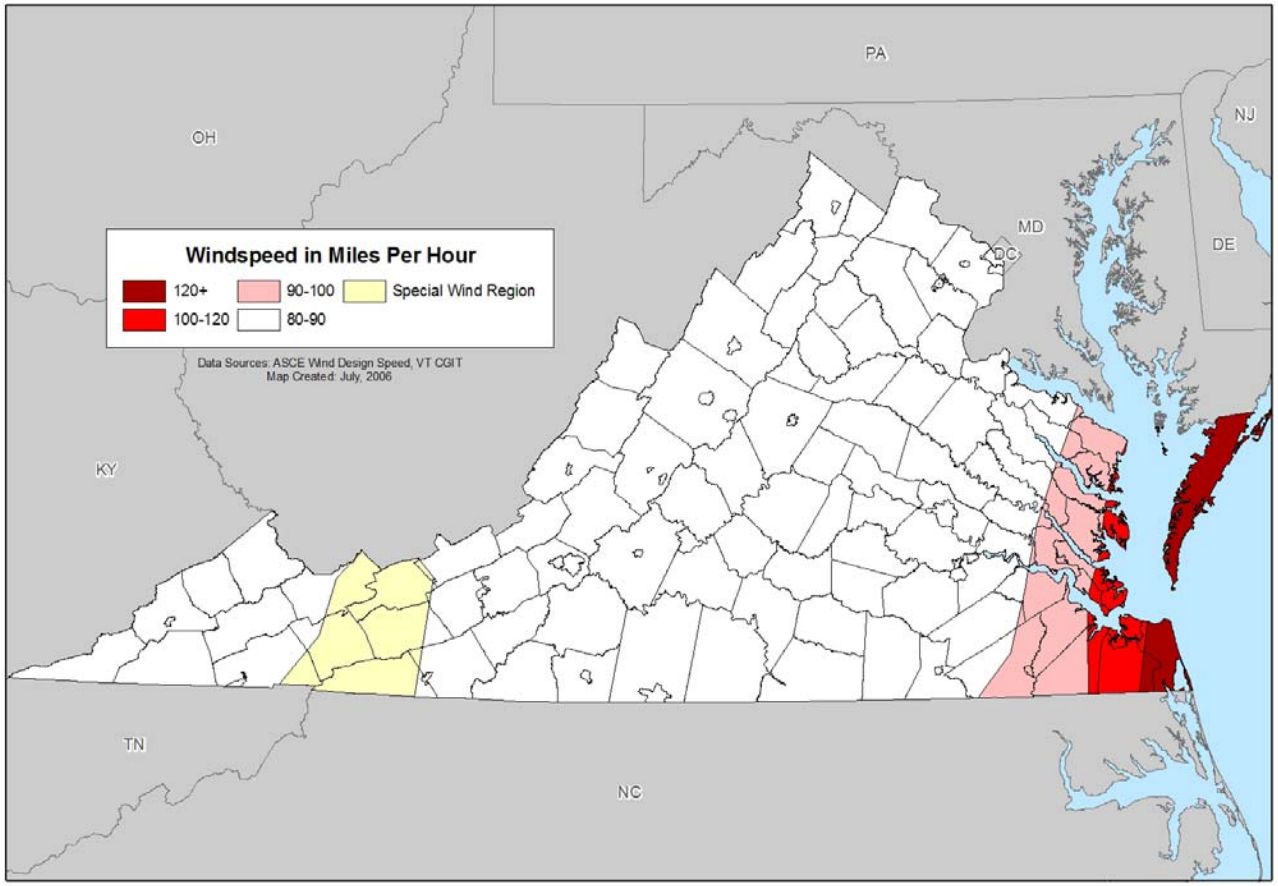


Location Map

Created using FEMA HAZUS-MH MR2

For Official Use Only

Virginia – Design Wind Speeds



HAZUS Quick Assessment Report

Quick Assessment Report

May 11, 2005

Regional Statistics

Area (Square Miles)	862
Number of Census Tracts	10
Number of Buildings	
Residential (x 1000)	49
Total (x 1000)	49
Number of People in the Region (x 1000)	73
Building Exposure ($ Millions)	
Residential	3,978
Total	4,372

Scenario Results

Peak Gust Wind Speed (mph) 165

Number of Buildings Damaged

Occupancy	*Minor*	*Moderate*	*Severe*	*Destruction*	*Total*
Residential	4,549	11,294	12,899	18,937	47,680
Other	17	53	126	12	208
Total	4,566	11,348	13,025	18,949	47,888

Shelter Requirements

Displaced Households (# Households)	20,377
Short Term Shelter (# People)	5,139

Economic Loss

Residential Property (Capital Stock) Losses ($Millions)	3,564.1
Total Property (Capital Stock) Losses ($ Millions)	3,828.1
Business Interruptions (Income) Losses ($ Millions)	674.3

Potential Uses:

- Estimate requirements for Individual Assistance PDA teams
- Identify potential requirements for roofing missions
- Scale housing mission requirements
- Use analysis in conjunction with other assessment tools

Potential Applications of HAZUS

Information and Planning

- *Area of Operations*
- *Displaced Households*
- *Essential Facilities Exposure*
- *Nursing Home Exposure*
- *Building Damage*
- *Short-Term Shelter Requirements*

Operations

- Evacuation Support
- Search & Rescue
- Essential Facilities Status
- Local Requests
- Staffing Needs

Human Services

- Shelter Status
- Food, Water & Ice

Infrastructure

- Critical Infrastructure Impacts
- Power Outages
- Airport Closures
- Route Clearance/Debris

Logistics

- Local Staging Areas
- Points of Distribution

Summary

- **HAZUS-MH allows you to:**
  - **IDENTIFY** vulnerable areas that may require planning considerations (e.g., land use or building code requirements)
  - **ASSESS** the level of readiness and preparedness to deal with a disaster before the disaster occurs
  - **ESTIMATE** potential losses from specific hazard events, including pre-event, near real-time, and post-event report capability
  - **DECIDE** on how to allocate resources for the most effective and efficient response and recovery
  - **PRIORITIZE** the mitigation measures that need to be implemented to reduce future losses

HAZUS MH Technical Discussion

- **System Requirements**
- **Data Formats**
- **National Data Set**
- **HAZUS MH Models**
- **What's coming in MR4/Future Releases**

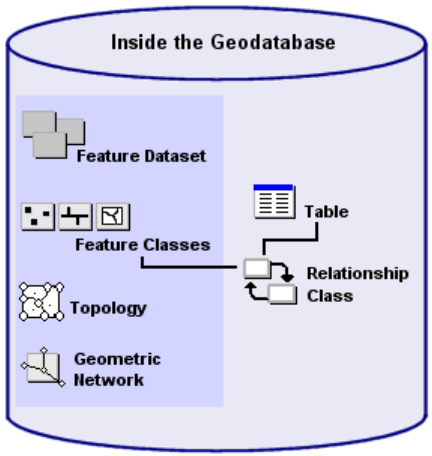
HAZUS Requirements

- **Requirements to operate HAZUS MH:**

	MINIMAL	MODERATE	PREFERRED
HARDWARE	Pentium® III 1 GHz core speed 512 MB RAM *Note:* *Allows moderately fast analysis of small communities only.*	Pentium® IV 2 GHz core speed 1 GB RAM *Note:* *Allows fast analysis of medium-sized communities or real-time analysis for small communities.*	Pentium® IV 3 GHz (or better) core speed 2 GB RAM *Note:* *Allows fast analysis of large urban areas and real-time analysis for all communities.*
COMPUTER STORAGE: FREE HARD DISK SPACE	10 GB Allows installation of HAZUS-MH and storage of three scenarios for a medium-sized community.	40 GB Allows installation of HAZUS-MH and storage of three scenarios for large urban areas.	120 GB Allows installation of HAZUS-MH and storage of 25 or more scenarios for large urban areas.
HARDWARE ACCESSORIES	DVD-ROM reader with 12x minimum read speed Graphics Card with 1024 x 768 minimum resolution Mouse, Keyboard and 19" Monitor		
SUPPORTING SOFTWARE	Microsoft Windows 2000 SP2, SP3, and SP4 Microsoft Windows XP SP1 and SP2 (U.S. English Version) ArcGIS 9.2 SP2 ArcGIS Spatial Analyst extension required for Flood Model *Note: Will not run on Windows Vista 64 bit*		

HAZUS-MH Data Formats

- **Spatial/GIS Data – ESRI Personal Geodatabase**
- **Non Spatial (Essential Buiding Stock, Attributes, etc)- MS SQL Server Express 2005**



		Category	Layer	Records Affected	Upload Date	Uploaded By
◉	🔍 ⊗	Essential Facilities	Emergency Operations Centers Facilities	45	01/10/2008	21908
○	🔍 ⊗	Essential Facilities	Fire Station Facilities	26	12/14/2007	jKnight

	Category	Layer	Records Affected	Upload Date	Uploaded By
⊗	Essential Facilities	Medical Care Facilities	221	12/11/2007	JSchmitz
⊗	Essential Facilities	Medical Care Facilities	5	12/11/2007	JSchmitz
⊗	Essential Facilities	Medical Care Facilities	5	12/11/2007	JSchmitz
⊗	Essential Facilities	Fire Station Facilities	62	12/07/2007	JSchmitz
⊗	Essential Facilities	Police Station Facilities	5	12/07/2007	JSchmitz
⊗	Essential Facilities	Emergency Operations Centers Facilities	6	11/29/2007	21678

Nationwide Databases

- **Demographics –** Population, Employment, Housing
- **Building Stock –** Residential, Commercial, Industrial
- **Essential Facilities –** Hospitals, Schools, Police Stations, Fire Stations
- **Transportation –** Highways, Bridges, Railways, Tunnels, Airports, Ports and Harbors, Ferry Facilities
- **Utilities –** Waste Water, Potable Water, Oil, Gas, Electric Power, Communication Facilities
- **High Potential Loss Facilities –** Dams and Levees, Nuclear Facilities, Hazardous Material Sites, Military Installations

HAZUS-MH: Models

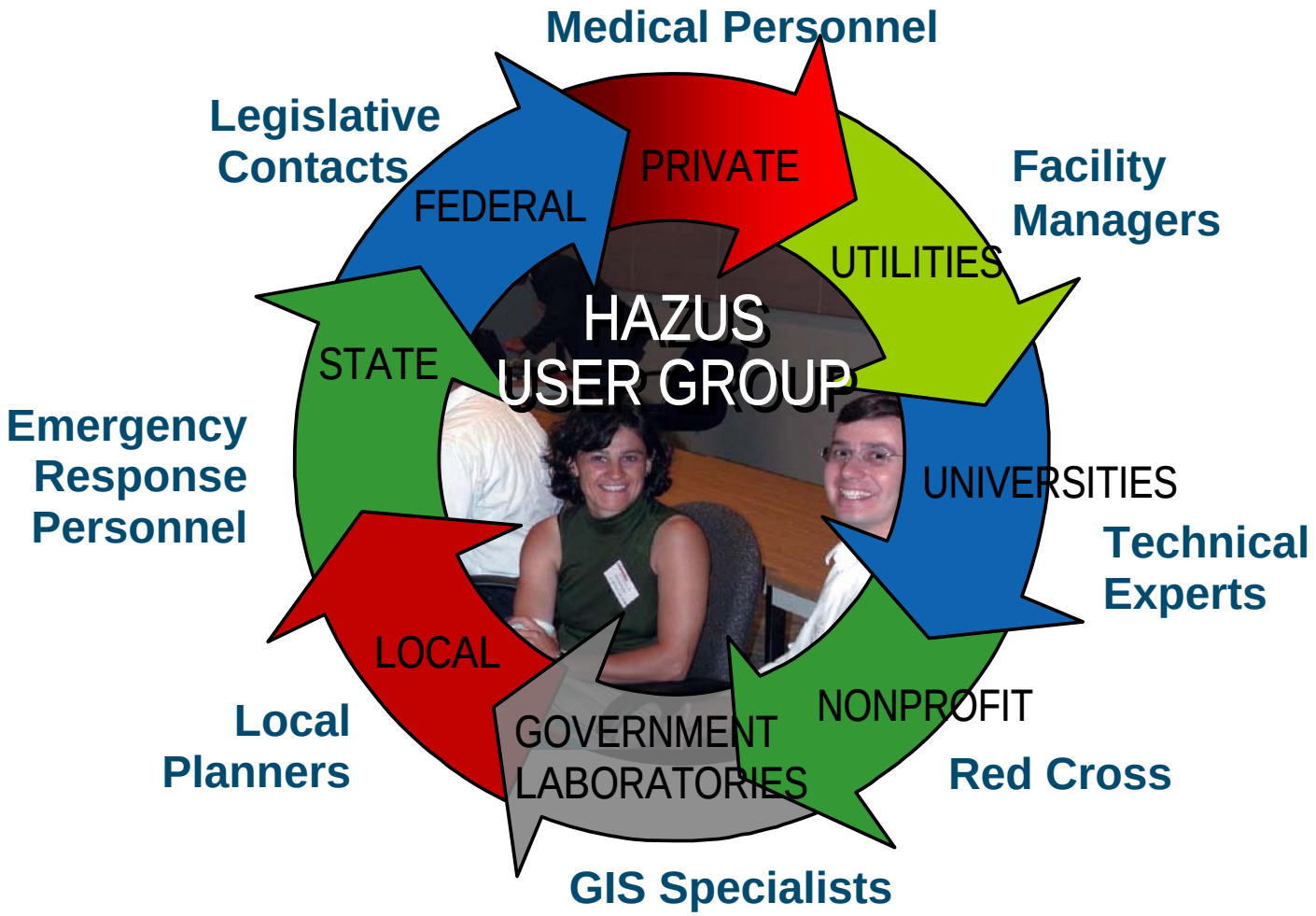
	Earthquake Ground Motion Ground Failure	Flood Frequency Depth Discharge Velocity	Hurricane Winds Pressure I Missile I Rain
Direct Damage			
General Building Stock	■	■	■
Essential Facilities	■	■	■
High Potential Loss Facilities	■		
Transportation Facilities	■	■	
Lifelines	■	■	
Induced Damage			
Fire Following	■		
Hazardous Materials Sites	■		
Debris Generation	■	■	■
Direct Losses			
Cost of Repairs/Replacement	■	■	■
Income Loss	■	■	■
Crop Damage		■	
Casualties	■		
Shelter and Recovery Needs	■	■	■
Indirect Losses			
Supply Shortages	■	■	
Sales Decline	■	■	
Opportunity Costs	■	■	
Economic Loss	■	■	

HAZUS-MH: FEMA'S SOFTWARE PROGRAM FOR ESTIMATING POTENTIAL LOSSES FROM DISASTERS

Future for HAZUS-MH MR4...*and beyond*

- **Platforms Changes Tentatively September 2008 –**
  - **Upgrade to ESRI ™ ArcGIS 9.3 Sept. 2008**
  - **Supports Windows Vista 32 Bit, Dropping Windows 2000 support.**
  - **Upgrade to SQL Server Express 2005**
- **Nationwide Datasets – Exploring our options for future data hosting and services**
  - **Must be Public Domain**
  - **Leverage efforts like National Map, SCEMD Portal**
- **Web Services? – Exploring use of OGC standards or other GIS Services to prototype HAZUS Models via SOA**

HAZUS: User Groups



Potential Committee Structure

- **Data Stewardship**
- **Training and Outreach**
- **Planning and Operations**

FEMA HAZUS Website – Great Resource

http://www.fema.gov/plan/prevent/hazus/index.shtm

- HAZUS Technical Manuals/Other Resources
- Best Practices
- HAZUS User Groups
- Training and Conferences
- Applications of HAZUS
- Frequently Asked Questions